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Parasite Records for the Douglas-fir Tussock Moth

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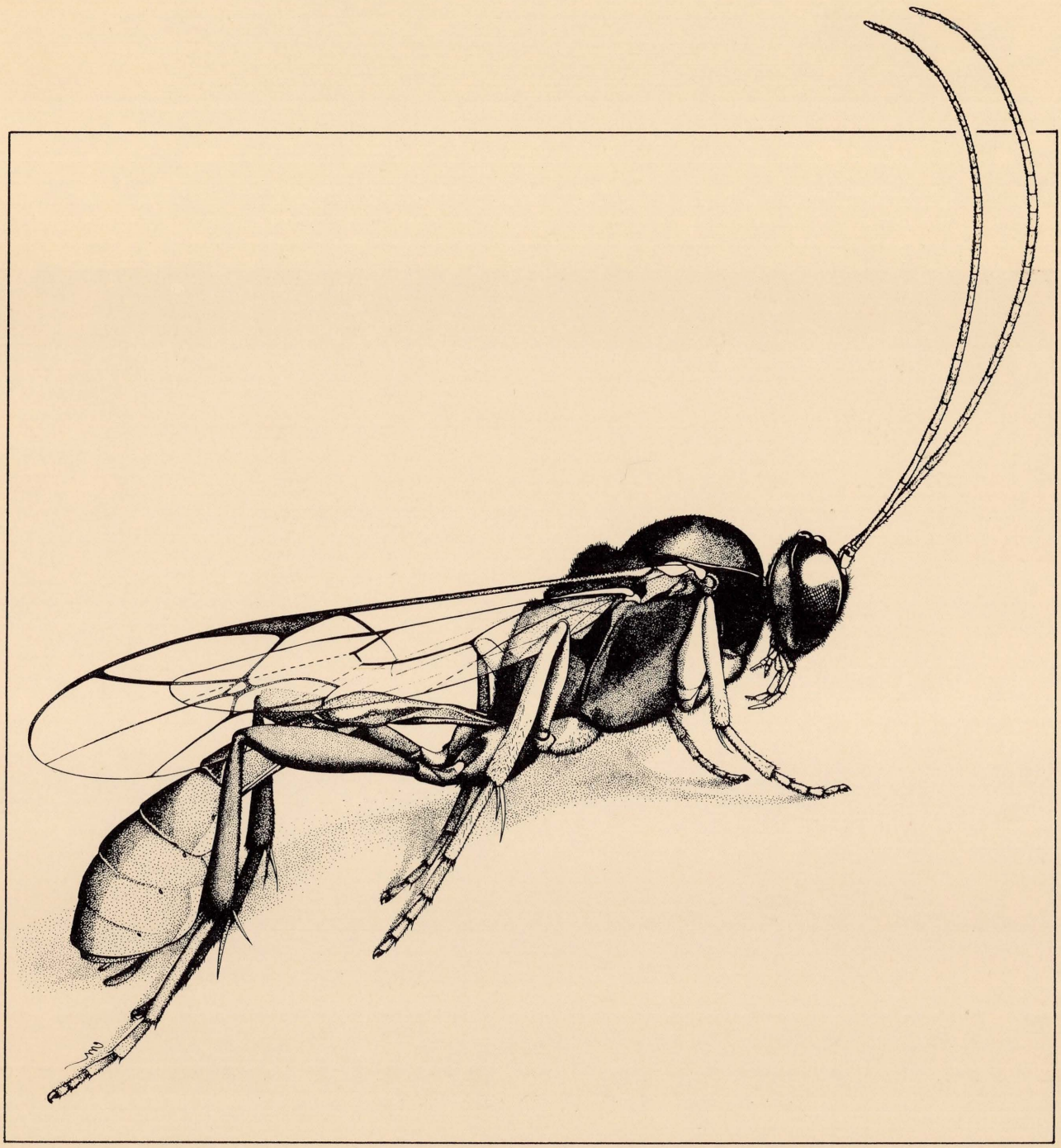

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Abstract

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This is an annotated assemblage of parasite and hyperparasite records for the Douglas-fir tussock moth. Species in more than 50 genera in the Hymenoptera and Diptera are included. These records are from published literature, unpublished reports, and other miscellaneous sources. These last sources include specimens reared by the author, species identification files (Hopkins US), personal communication with collectors and taxonomists, and determinations by the author of material in collections throughout the West.

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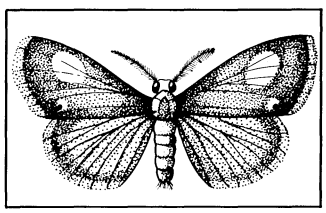
Introduction

The earliest recorded rearing of parasites of the Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.), is dated from the early part of the century (Burke 1906). Not until the 1930's was further interest shown in tussock moth parasites. The work of Balch (1932) was on the biology of the insect and was specific in its attention to the parasites; although the records by Bedard (1938) were a result of incidental rearings of tussock moth parasites, the main objective was to survey the insect fauna associated with Douglas-fir trees.



In the mid-1950's, the tussock moth again assumed prominence (Dodge 1956; Eaton and Strubble 1957), but not until more than a dozen years later did authors begin to publish more detailed studies of the insect's biology, population behavior, and parasites (Dahlsten et al. 1970; Wickman et al. 1973a, b; Mason 1976).

The inception of the USDA Expanded Douglas-fir Tussock Moth Research and Development Program in 1974 renewed interest in all aspects of tussock moth biology including its natural enemies. As an adjunct to investigations into the regulatory roles of parasites and predators of the tussock moth, I assembled and interpreted the bibliographic and supplemental records presented here. These records are in part from the published literature. Supplementary or miscellaneous sources were unpublished reports, species identification files (i.e., Hopkins US records), correspondence, and other personal communications with investigators. Many records are based on determinations of material in the PNW Forestry Sciences Laboratory[1] tussock moth voucher collection, or of specimens sent to me by investigators or stored in collections throughout the West.

Because of changes in taxonomic status of many parasites and of the host as well, some host/parasite literature was difficult to interpret. Citations occasionally mentioned parasites in nonspecific terms, such as "tachinids," "scelionids," or "tiny wasps," or contained a comment on parasite biology, such as reference to multiple emergence from a single host egg. Often I was able to make a subjective determination of the species, based on other records, geographic distribution, species dominance, or characteristic features of the parasite's biology.

Much of this paper is in the form of an annotated bibliography and includes references to both published and unpublished documents. Complete citations for unpublished works appear in a separate bibliography after references for published papers. Numerous references to collectors and to individuals with whom I communicated concerning records appear in the text. Those individuals are identified in the directory at the end of this paper.

Notations in brackets, e.g. [PNW], [R-1], indicate the location of collections in which the specimens referred to are housed. Administrative units and the location of the collections are identified in the list of abbreviations below.

[1]See Abbreviations, next section.

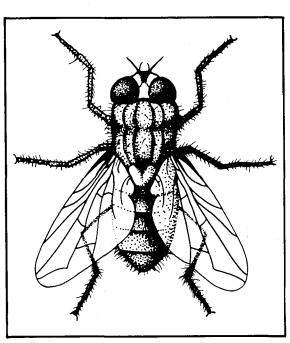
Abbreviations

The following identify the abbreviations used in the text: AEI, American Entomological Institute, Ann Arbor, Michigan; CNM, Canadian National Museum, Biosystematics Research Institute, Ottawa, Canada; FIDS, Forest Insect and Disease Survey, Pacific Forest Research Centre, Victoria, British Columbia, Canada; INT, Intermountain Forest and Range Experiment Station, Missoula, Montana; RM, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado; R-1, Region 1, USDA Forest Service, State and Private Forestry, Missoula, Montana; R-2, Region 2, USDA Forest Service, State and Private Forestry, Lakewood, Colorado; R-3, Region 3, USDA Forest Service, State and Private Forestry, Albuquerque, New Mexico; R-4, Region 4, USDA Forest Service, State and Private Forestry, Boise, Idaho; PNW, Pacific Northwest Forest and Range Experiment Station, Forestry Sciences Laboratory, Corvallis, Oregon; USNM, U.S. National Museum, Smithsonian Institution, Washington, D.C.; (sic) indicates an error in the original document.

Diptera

Agria housei Shewell — Sarcophagidae

The earliest reference to this species on tussock moth appeared in a report by Balch (1930 unpub.), which contains observations on dipterous parasites from host cocoons collected at Weiser, Idaho, and Jarbidge, Nev. The puparium of an unidentified species is illustrated and described in sufficient detail for me to identify it as *A. housei.* This species was secondary in importance to a tachinid, *Carcelia yalensis.* The first published reference to this species on tussock moth appeared in a popularized article by Dodge (1956). In it he mentions a species of sarcophagid fly which, in a later report (Dodge 1956 unpub.), he identifies as *Pseudosarcophaga affinis* (Fall.). In these references, Dodge attributed two-thirds of the 64 to 96 percent cocoon mortality in forest situations near Colville, Wash., and Orofino, Idaho, to this fly. Curiously, the fly was rare or absent among hosts collected on farmsteads. Persistence of high numbers of egg masses from 1955 to 1956 in farmstead areas near Spangle-Latah, Wash., were attributed to low numbers of *A. housei* there. This species appeared to have a competitive advantage because, when it was present, parasitization by other species was very low. In the absence of *A. housei,* hymenopterous parasites caused up to 28 percent mortality. What appears to be another reference to this species in the same infestation appears in Wickman et al. (1973b), who cite the presence of *Pseudosarcophagae* (sic) *affinis* during an outbreak in eastern Washington forests in 1955. Shewell (1971) described *Agria housei* n. sp. based on an analysis of taxonomic history, original descriptions, and comparisons of types for *Agria, Pseudosarcophaga,* and *Musca* species. Both *A. affinis* and *P. affinis* were synonymized with the new species. *Hemerocampa pseudotsugata* (of authors) was listed among a dozen hosts for the species.



The species appears again in the literature (Mason 1976) as a common parasite of the host in infestations near La Grande, Oreg., in 1973 and 1974 [PNW]. In a report by Volker et al. (1977 unpub.), *A. housei* is listed from host larvae collected near Coeur d'Alene, Idaho, and Flathead Lake, Mont. [UI]. Collections from Peterson Point and Emida Peak, Idaho, and near La Grande, Oreg., did not contain the species. The presence of the species in collections by Mason (1976) probably results from the much higher host densities near the peak and decline phases of the Blue Mountains outbreaks of the early 1970's.

A. housei is included in a key to parasites of tussock moth, with a supplemental diagnostic description and brief biological notes by Torgersen (1977). It was also reared from hosts collected near Curlew, Wash., in 1930 (Hopkins US 18182-D) [PNW], and from interior British Columbia in 1961 and 1962 (D. Evans, [2] personal communication) [FIDS]. I identified specimens of this species from hosts collected near Kamloops, B.C., 1976, and Flathead Lake, Mont., 1975, by J. D. Ward [R-1]; near Silver City, Idaho, 1976, by R. Beveridge [R-4]; and near Malin, Oreg., in 1978 by H. G. Paul [PNW].

Pseudosarcophaga affinis (Fall.) Sarcophagidae

See *Agria housei* Shewell

Compsilura concinnata (Meigan) Tachinidae

According to a report by McComb (1973 unpub.), this introduced species and the ichneumonid *Pimpla turionellae* were released near Hailey, Idaho, in 1939 to obtain establishment on the tussock moth. Neither species was ever recovered in attempts to assess establishment. Mention of this species by McComb appears to be an unreferenced citation from another source.

[2]Identification of collectors and individuals with whom I communicated personally appear in the Directory at the end of this paper. Correspondence is on file at the Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, Oregon 97331.

Exorista mella (Walker) Tachinidae

This species, which emerges from host pupae, was reared from larvae of what was known as *Notolophus oslari* Barnes collected in Yosemite National Park, Calif., by Burke (1906). Then listed as *Tachina mella* Walk., it was synonymized with *E. mella* in Stone et al. (1965), and the host was synonymized with *Orgyia pseudotsugata* by Eaton and Strubble (1957).

I included *E. mella* in a key to parasites of this host, with supplemental diagnostic and biological notes (Torgersen 1977). Jennings (1975 unpub.) recorded the species from hosts collected in urban Los Alamos and Santa Fe, N. Mex. [PNW]. I also know of specimens reared from host pupae collected by G. Starr [R-4] near Oreana, Idaho, in 1971 (A. C. Valcarce, personal communication) [R-4], and near Placerville, Calif., in 1970 [PNW]. Volker et al. (1977 unpub.) obtained this species near Flathead Lake, Mont., in 1975 and 1976 [UI]. I identified the species from hosts collected in that same area in 1975 by J. D. Ward [R-1], and near Rupert, Idaho, in 1976 by A. C. Valcarce [R-4].

Leschenaultia americana (Brauer & Bergenstamm) Tachinidae

According to D. Evans (personal communication), two specimens of this species were reared from host larvae collected near Otter Lake, B.C., in June 1963 [FIDS]. To my knowledge, this is the first record of the species on tussock moth.

Carcelia olenensis Sellers Tachinidae

Rearing records examined by D. A. Ross (personal communication) indicate that two specimens of this tachinid were obtained from hosts collected near Ashcroft and Carquile, B.C., in 1948 [FIDS]. This is the only record of a *Carcelia* species other than *yalensis* that I am aware of.

Carcelia yalensis Sellers Tachinidae

This is the dominant dipterous parasite throughout the host's range. In papers by Balch (1930 unpub., 1932), he refers to a tachinid that was extremely common in host rearings from Weiser, Idaho, and Jarbidge, Nev., in 1929. Eighty-five percent of the cocoons were killed by this unidentified tachinid. Notes in his unpublished report lead me to believe that he was unable to obtain adult emergence from the puparia, which would have required cold storage to simulate overwintering diapause before emergence could take place. He illustrated the puparium, including the spiracles, however, and—based on this—I believe the species to be *C. yalensis.*

According to C. W. Sabrosky (personal communication), a specimen of what was identified as *Carcelia* sp. nr. *perplexa* was obtained from hosts collected near Curlew, Wash., in 1930. *C. perplexa* closely resembles *C. yalensis,* and I believe that the species may actually have been the latter.

Dahlsten et al. (1970) obtained puparia of an unidentified tachinid from rearings of host larvae and cocoons collected at Fredonyer Peak, Calif., in 1964 and 1965. Later studies in the same area in the early 1970's (Dahlsten et al. 1977) yielded great numbers of *C. yalensis,* which I surmise is the same species reported in the earlier study. Dahlsten et al. recognized tachinids as the most common of all the parasites reared during their studies in the central Sierras of California in 1971-73. A total of 73 percent of all parasitism was attributable to this group. Only a few adults of *C. yalensis* were successfully reared and identified, and many of the tachinids were this species. More than one tachinid species may have been present, however. All of these apparently attacked the late instars, and emerged from the cocooned pupae. Pupation took place in the ground litter. The results of work by Tunnock et al. (1976) near Moscow, Idaho, in 1965, and Mason (1976) in the Blue Mountains of northeastern Oregon in 1972-74, were similar to those observed in California. *C. yalensis* accounted for the greatest mortality of cocooned hosts from all parasites. Mason observed that in late July the adult flies were so numerous that their buzzing was conspicuous in stands infested with tussock moth. The same phenomenon was observed by W. Buckhorn (PNW) at an outbreak site near Mt. Vernon, Oreg., in 1938. The adults oviposited on late larvae, and the maggot emerged from the cocooned host to drop to the ground where it pupated in the litter. One, two, and occasionally three parasites may issue from one host. In the course of collections from former tussock moth outbreak sites, Volker et al. (1977 unpub.) found that *C. yalensis* was still dominant near Flathead Lake, Mont., in 1975. It was scarce at Emida Peak, and absent at Peterson Point and Coeur d'Alene, Idaho, and near La Grande, Oreg., where it had been very common in the early 1970's during the height of the outbreak.

I have identified or verified specimens of this species from hosts collected by V. M. Carolin near Burns, Oreg., in 1964 and 1965 [PNW]; by M. Ollieu near Silver City, Idaho, in 1976 [R-4]; by L. Yarger near Denver, Colo., in 1976 [PNW, R-2]; by R. R. Mason near Ft. Klamath, Oreg., in 1975, 1976, and 1978 [PNW]; and by H. G. Paul near Malin, Oreg., in 1978, and near Placerville, Calif., in 1978 and 1979 [PNW].

Madremyia saundersii (Williston) Tachinidae

Personal communication with C. W. Sabrosky indicated that this species was identified by D. G. Hall as a parasite of tussock moth collected near Hailey, Idaho, in 1937 (Hopkins No. 21954).

Thelymyia mathesoni (Reinhard) Tachinidae

C. W. Sabrosky and M. T. James (personal communication) confirmed that *T. mathesoni* was reared from a host at Kamiak Butte, near Pullman, Wash., in 1966 [USNM].

Hymenoptera

Ichneumonoidea

Meteorus hyphantriae Riley — Braconidae

This species appears only rarely in rearings of tussock moth. The only published record from this host indicates that it was the fifth most abundant of six larval parasites. It was reared from hosts collected as first to third instars in an infestation near Coeur d'Alene, Idaho, in 1974 (Tunnock et al. 1976). I verified the above specimens (Hopkins No. 58979), and others from Polson, Mont., collected in 1975 [R-1, PNW]. Emergence of these specimens was from a late instar.

Meteorus tersus Muesebeck — Braconidae

I included this species in a key to common tussock moth parasites; supplemental diagnostic and biological notes are also given (Torgersen 1977).

Tunnock et al. (1976) found this species to be the second most abundant larval parasite among the same six species that contained *M. hyphantriae,* above. It was most common from hosts collected as early instars, but all instars appeared to be attacked. The same species continued to appear in host collections in the Coeur d'Alene, Idaho, area despite a dramatic drop in host density (Volker et al. 1977 unpub.).

I identified a series of specimens of this species collected in conjunction with evaluations of chemical spray tests for tussock moth near La Grande, Oreg., by P. J. Shea in 1973, and near Coeur d'Alene, Idaho, by M. J. Stelzer in 1974. Dahlsten et al. (1977) listed an unidentified *Meteorus* species as one of four larval parasites during studies of host populations in El Dorado Co., Calif., from 1971 to 1973 [UC]. The parasite was reared from fourth instar hosts and occurred only sporadically. A similarly unidentified *Meteorus* was reared from hosts collected near Kamloops, B.C., by J. D. Ward [R-1]. I have examined isolated specimens of *M. tersus* from studies R. R. Mason and I conducted near Ft. Klamath, Oreg., in 1975 and near Placerville, Calif., in 1979 [PNW].

Apanteles sp. — Braconidae

Records of unidentified species of *Apanteles* appear several times in the tussock moth parasite literature. In a revision by W. R. M. Mason (1981), the author divides *Apanteles* into nearly two dozen genera. According to Mason (personal communication) who has examined a large series of *Apanteles* from our collection [PNW], the specimens reared from tussock moth are really two undescribed species; one is a new species of *Cotesia* near *delicatus,* and the other is a new species of *Glyptapanteles,* both of which are treated below.

In my key to parasites of tussock moth (Torgersen 1977), both *Cotesia* and *Glyptapanteles* species will key to *Apanteles.*

Apanteles delicatus Howard — Braconidae

See *Cotesia* n. sp.

Cotesia n. sp. — Braconidae

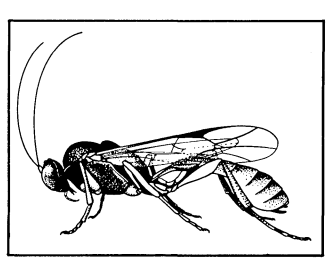
This species appears to be a northern component of *Apanteles,* reared from tussock moth. Volker et al. (1977 unpub.) reared this species, identified as *A. delicatus,* from hosts collected near St. Ignatius, Mont., and near Kamloops, B.C., in 1976 [UI]. Another series of specimens, also from the vicinity of Kamloops, collected by J. D. Ward were identified by W. R. M. Mason as *Cotesia* n. sp. [CNM].

The southernmost collection location for this species on tussock moth is near Ft. Klamath, Oreg., where R. R. Mason and I reared it in connection with life-table studies in 1976 (Mason and Torgersen 1977 unpub.). The record for *A. delicatus* in Torgersen and Dahlsten (1978) is *Cotesia* n. sp.

Glyptapanteles n. sp. — Braconidae

According to determinations by W. R. M. Mason of specimens cited by Dahlsten et al. (1977) as an unidentified species of *Apanteles,* the species is actually a new *Glyptapanteles.* The reference listed the species as one of four larval parasites of the host in El Dorado Co., Calif., in 1971 and 1972. A footnote in the same paper indicates that the authors also reared the species from hosts collected in Modoc Co., Calif., in 1964 and 1965. Other specimens of the same species, also identified by W. R. M. Mason, were collected again in 1977 at the same location by R. R. Mason and me [CNM]. Additional rearings of the species originated from El Dorado Co., in 1972, 1976, and 1977, and from San Bernardino Co., Calif., in 1975. A single specimen was reared by R. R. Mason from hosts collected near Alturas, Calif., in 1977. First and second instars of the hosts that I collected in El Dorado Co., in 1978, and those collected by R. R. Mason near Ft. Klamath, Oreg., in 1975-77, produced this species [CNM, PNW].

Several specimens of this species from hosts collected at Aztec Peak, Tonto National Forest, Arizona, in 1967 and 1976-79 are in our collection [CNM, PNW].



Bracon xanthonotus Ashmead Braconidae

The first record of this parasite, as *Microbracon xanthonotus* from a host cocoon, was published by Bedard (1938). Bedard's purpose was to assemble a list of the insect fauna associated with Douglas-fir in the northern Rocky Mountains, not aimed at either the tussock moth or its parasites. Surprisingly, neither of the parasites he obtained was or would be considered a dominant species based on what appears in this treatment of the host's parasites. See also *Itoplectis quadricingulata.*

Dahlsten et al. (1970), who studied parasites of tussock moth throughout much of its range in California, reared this species from cocoons collected in Lassen County in 1964 and 1965 [UC]. In a later paper which described studies in Placer and El Dorado Counties in 1971 and 1972, the authors found this species to be very common. More specifically, they determined that it was a gregarious primary parasite that only emerged from cocoons containing larvae (Dahlsten et al. 1977) [UC]. I examined specimens and verified rearing records of this species obtained from different El Dorado County sites in 1966 and 1970 [PNW].

Additional northern Rocky Mountain records for this species appear in Tunnock et al. (1976) and Volker et al. (1977 unpub.), for locations near Flathead Lake, Mont. [UI], and Coeur d'Alene, Idaho [R-1]. Personal communications with A. C. Valcarce and S. Tunnock, and examinations of Hopkins file data [INT] indicate rearings from hosts collected near Fairfield, Idaho, by A. C. Valcarce; near Northport, Wash., by D. DeLeon in 1930 (Hopkins US 19914-1); near Rice, Wash., by P. C. Johnson in 1947 (Hopkins US 21556 and 21558a-c); near Silver City, Idaho, by H. R. Dodge and W. E. Cole in 1957 (Hopkins US 15867), and by A. C. Valcarce in 1973 [INT, R-4]; near Ft. Klamath, Oreg., in 1975, and near Malin, Oreg., in 1978 by H. G. Paul [PNW]. Dodge and Cole believed this species required an alternate host to complete its life cycle, and that the species was widespread in the host range. *B. xanthonotus* is included in a key to common parasites, with supplemental diagnostic and biological notes in Torgersen (1977).

Scambus hispae (Harris) Ichneumonidae

The only published record for this species is documented by Dahlsten et al. (1977), who studied the host in El Dorado and Placer Co., Calif., in 1971 and 1972. They found that the species emerged from field-collected cocoons parasitized by the primary parasite *Gambrus canadensis burkei,* and tentatively recorded it as a facultative secondary parasite [UC]. Information supplied by D. Evans (personal communication) indicates rearings of this species from hosts collected near Vernon and Winfield, B.C., in 1963 [FIDS]. I identified specimens of *S. hispae* reared from hosts collected in New Mexico in the Sandia Mountains in 1959 by A. Rivas [PNW], near Ruidoso in 1975 by D.M. Jennings [PNW], and a specimen from Potlatch, Idaho, collected in 1973 [PNW]. An unidentified species of *Scambus* was reared from host(s) collected in the Manzano Mountains of New Mexico in 1959 (Yasinski and Wheeler 1962 unpub.) [R-3]. I included this genus in a key and descriptive notes for separating tussock moth parasites (Torgersen 1977).

Pimpla pedalis Cresson — Ichneumonidae

See *Coccygomimus pedalis* (Cresson).

Pimpla sanguinipes Cresson — Ichneumonidae

See *Coccygomimus sanguinipes erythropus* (Viereck).

Pimpla turionellae (L.) — Ichneumonidae

According to a report by McComb (1973 unpub.), this introduced species—and also the tachinid *Compsilura concinnata* (Meigan)—were released near Hailey, Idaho, in 1939 in hopes of obtaining establishment; neither species has ever been recovered on tussock moth.

Iseropus stercorator orgyiae (Ashmead) — Ichneumonidae

Cushman (1940), in a diagnosis of the genus, presented characteristics that distinguish it from other closely related genera. He states that *Iseropus* species are gregarious parasites within the cocoons of Macrolepidoptera—the host is in the late larval stage when attacked and the parasite larvae feed externally. *I. orgyiae* (Ashmead) and *I. brunneifrons* (Viereck) are given as new combinations. These two species were reared from *Hemerocampa vetusta gulosa* and *H. oslari* (Barnes)—*H. oslari* is actually *O. pseudotsugata* after Eaton and Strubble (1957)—from Summerdale, Calif. (USNM No. 12273) [USNM]. A new subspecies, *I. brunneifrons septentrionalis,* is also described in the paper, and the host for the type is *H. pseudotsugata (= Orgyia pseudotsugata)* from Washington (Hopkins US 53566) [USNM]. *I. brunneifrons, I. b. septentrionalis,* and *I. orgyiae* have since been synonymized with *I. stercorator orgyiae* (Townes and Townes 1960).

Hopkins card data [INT] show rearings of this species from host cocoons collected near Rice, Wash., by P. C. Johnson in 1947 (Hopkins US 21559 a-e), and near Colville, Wash., by H. R. Dodge in 1956 (Hopkins US 15829). The specimens were identified as *I. brunneifrons.* Other Hopkins card data [RM] indicate several records of specimens reared from hosts collected in 1974 and 1975 near Los Alamos, Ruidoso, and Santa Fe, N. Mex. I determined additional specimens collected near Potlatch, Idaho, and Missoula, Mont., in 1973 [R-1].

The species was reasonably common in rearings conducted by Dahlsten et al. (1970, 1977) in northeastern California and the central Sierra Nevadas in the mid-1960's and early 1970's [UC]. In Idaho, the parasite was commonly reared from hosts collected as cocooned prepupal larvae or pupae during outbreaks in the early 1970's near Coeur d'Alene; it was actually the dominant cocoon parasite of the four listed by Tunnock et al. (1976). The species is also recorded from the Blue Mountains of Oregon (Mason 1976) [PNW], the Sandia Mountains, N. Mex. [R-3] (Rivas 1959 unpub.), and in British Columbia near Okanagan Landing and Vernon in 1961, and again from Vernon in 1963 [FIDS] (D. Evans, personal communication).

Itoplectis quadricingulata (Provancher) Ichneumonidae

This species has been recorded rather commonly throughout the range of the host, but nowhere does the literature indicate that it was a major or dominant form. This parasite has a wide host range (Krombein et al. 1979) and apparently does not specialize on tussock moth even if it is readily available in large numbers.

Bedard (1938) recorded it under the synonym *I. montanus* Cushman from cocoons of the host. It was obtained from rearings of hosts collected in northeastern California and the central Sierras by Dahlsten et al. (1970, 1977) [UC]. The authors believed that it oviposited only on cocooned hosts. I have examined specimens and records of rearings from hosts collected near Northport, Wash., by D. DeLeon in 1930 (Hopkins US 19850-1) [INT], and near De Lamar, Idaho, by H. R. Dodge in 1957 (Hopkins US 15868) [INT]; the specimens were recorded under the replaced synonym *I. 4-cingulatus.* In studies on the parasite complex of the tussock moth and associated defoliators, Volker et al. (1977 unpub.) found *I. quadricingulatus* (sic) on this host, as well as *Choristoneura occidentalis* and *Acleris variana* in the same sites [UI]. Specimens in our collection [PNW] represent rearings from hosts collected in urban Los Alamos, N. Mex., in 1974 and 1975 by D. T. Jennings; near Troy, Oreg., in 1947 by R. L. Furniss (Hopkins US 33256E); near Malin, Oreg., in 1978, and near Ft. Klamath, Oreg., in 1978 and 1979 by H. G. Paul [PNW].

Although the species usually behaves as a primary parasite, I have observed its hyperparasitic habit as well. I identified two specimens reared from cocoons of an undescribed species of *Hyposoter* that were collected from branches infested with tussock moth near Burns and Lakeview, Oreg., in 1966 [PNW].

Itoplectis viduata (Gravenhorst) Ichneumonidae

This is the most cosmopolitan of the parasites attacking the cocooned host. Not only is it represented widely throughout the host range on tussock moth, but it also has a wide variety of other lepidopteran hosts with exposed or poorly protected pupae (Townes and Townes 1960). Some of the earliest records for this species refer to it by the replaced synonym *I. atrocoxalis* (Cresson). The specimens were from hosts collected near Curlew, Wash., in 1930 [PNW], and near Hailey, Idaho, by F. S. Moore in 1937 (Hopkins US 21939) [INT]. Dahlsten et al. (1970) listed the species from larval and cocooned hosts from northeastern California in 1964 and 1965. They listed this species later as a primary parasite attacking prespinning host larvae and emerging from the pupal host of cocoons from the central Sierras in 1971-73 (Dahlsten et al. 1977) [UC]. Tunnock et al. (1976) indicated that *I. viduata* was the third most common of four cocoon parasites in an outbreak area near Coeur d'Alene, Idaho. The species is listed as a dominant cocoon parasite by Torgersen and Dahlsten (1978), and it is included in my key to tussock moth parasites (Torgersen 1977).

The following list summarizes other records of *I. viduata* on this host:

Locality	Source
Iron Mt. and Plummer Ridge, El Dorado Co., Calif.	Collected in 1970 by C. G. Thompson [PNW].
	Collected in 1978 and 1979; unpublished data on file, PNW, Corvallis, Oreg. [PNW].
Near Oreana, Idaho	Collected in 1971 by A. C. Valcarce [R-4].
Near Silver City, Idaho	Collected in 1957 (Hopkins US 15869) [INT].
	Collected in 1976 by M. M. Ollieu, personal communication [R-4].
Near Flathead Lake, Mont.	Collected in 1975 by J. D. Ward, personal communication [R-1].
Manzano Mts., N. Mex.	Yasinski and Wheeler (1962 unpub.) [RM].
Sandia Mts., N. Mex.	Collected in 1959 by A. M. Rivas, personal communication [RM].
Urban Los Alamos, and at Trigo Canyon, N. Mex.	Collected in 1975 (Jennings 1975 unpub.) [PNW].
Urban Santa Fe, N. Mex.	Collected in 1975 by D. T. Jennings, personal communication [PNW].
Blue Mts., Oreg.	Collected in 1973 and 1974 (Mason 1976) [PNW].
Ft. Klamath, Oreg.	Collected 1975-1979 (Mason and Torgersen 1977 unpub.), and other data on file, PNW, Corvallis, Oreg. [PNW].
Malin, Oreg.	Collected by H. G. Paul in 1978; data on file at PNW, Corvallis, Oreg. [PNW].
Near Vernon and Okanagan Landing, B. C.	Collected in 1961, D. Evans, personal communication [FIDS].

Apechthis componotus Davis — Ichneumonidae

See *Ephialtes componotus* (Davis).

Ephialtes componotus (Davis) — Ichneumonidae

Apechthis componotus was synonymized with *E. componotus* by Townes (1969). This parasite shares the cosmopolitan distribution that I observed for *Itoplectis viduata* during outbreak phases of the host. *E. componotus* differs, however, in that rather than being dominant at high host densities like *I. viduata,* it seems to comprise a greater proportion of the parasite complex at sparse host densities (Torgersen and Dahlsten 1978, Mason and Torgersen 1977 unpub.). Actually, Mason and I collected this species every year from 1975 to 1979 when host densities were very low.

The earliest record I have seen for this parasite is from Curlew, Wash., in 1930, which appears in the Hopkins US file at PNW. Dahlsten et al. (1970, 1977) reared it from host cocoons obtained in study sites in northeastern California in 1964 and 1965, and in the central Sierras in 1971 and 1972 [UC]. In the central Sierras, it was collected by M. J. Stelzer and R. R. Mason in 1970, 1978, and 1979 [PNW]. Volker et al. (1977 unpub.) reared this parasite from hosts collected near Flathead Lake, Mont., in 1975 and 1976. I also identified this species from tussock moth hosts collected in the same locality in 1975. It was reared from hosts collected in 1974 near Coeur d'Alene, Idaho (Tunnock et al. 1976) [R-1]. We also reared this parasite during a period of host decline near Malin, Oreg., in 1978 [PNW]. I included this species in a key to tussock moth parasites (Torgersen 1977).

Ephialtes sanguineipes (sic) (Cresson) — Ichneumonidae

See *Coccygomimus sanguinipes erythropus* (Viereck).

Coccygomimus pedalis (Cresson) — Ichneumonidae

This species has been recorded only sporadically on tussock moth. Mathers (1949) stated that a species tentatively identified as *Pimpla pedalis,* a replaced synonym, was one of the most common hymenopterans in stands heavily infested with tussock moth in the Thompson River Valley in British Columbia. Hopkins US file data at R-1 and R-4, respectively, indicate collection of this species at Potlatch, Idaho, in 1973, and near Oreana, Idaho, in 1971.

Coccygomimus sanguinipes erythropus (Viereck) Ichneumonidae

The first record of this species on tussock moth was published by Balch (1932), who listed it as *Ephialtes sanguineipes* (sic). According to the synonyms set forth by Townes and Townes (1960) and Krombein et al. (1979), the species in Balch should be *C. s. erythropus.* The collection from which Balch obtained this species was from a site near Jarbidge, Nev., in 1929 (Balch 1930 unpub.), but collections were made at both that site and in the Weiser (now the Payette) National Forest, possibly near McCall, Idaho. A year later, the parasite was obtained from collections near Northport, Wash., (Hopkins US 19928) [R-1].

A variety of records, some as *Pimpla sanguinipes,* indicate the presence of this species in New Mexico, where it was collected in the Sandia and Manzano Mountains in 1959 (Rivas 1959 unpub., Yaskinski and Wheeler 1962 unpub.). I have since verified the specimens collected by A. M. Rivas [PNW]. More recently, Jennings (1975 unpub.) obtained specimens from hosts collected at urban sites in Los Alamos, Ruidoso, and Santa Fe, N. Mex. In California, Dahlsten et al. (1970, 1977) reared the species, as *C. (= Pimpla) sanguinipes erythropus,* from cocooned hosts at sites in the northeastern part of the State and in the Sierras, in the early 1960's and 1970's. Personal communication with A. C. Valcarce indicates that the species emerged from hosts collected by G. Starr [R-4] near Oreana, Idaho, in 1971 [R-4]. We reared this species from cocoons collected after the collapse of an outbreak near Malin, Oreg., in 1979 (unpublished data on file at PNW). Biological and diagnostic notes, and a key for identifying this species appear in Torgersen (1977).

Theronia atalantae (Poda) Ichneumonidae

See *Theronia atalantae fulvescens* (Cresson).

Theronia atalantae fulvescens (Cresson) Ichneumonidae

A species tentatively identified as "*Theronia stalantae* (sic) var. *fulvescens* (Cresson)?" was reared from host material collected near Northport, Wash., in 1929 (Balch 1930 unpub.). This was considered the most important parasite in the Washington outbreak. The author described the biology of the species and illustrated both immature and adult forms. The same species is identified as *T. fulvescens* (Hopkins US 18709, 19919) in a later published paper (Balch 1932). *T. fulvescens* was synonymized with *T. a. fulvescens* by Townes and Townes (1960), who stated that it is usually associated with mesophytic habitats. It is a common parasite of medium-sized Lepidoptera, particularly those pupating on tree trunks. The authors hypothesize that this species may overwinter as adult females. Other hosts are *Choristoneura fumiferana, Lambdina fiscellaria somniaria, Malacosoma americanum, M. californicum, M. fragile, Malacosoma* sp., *Neophasia menapia, Nepytia phantasmaria, Nymphalis californicus, Oreta rosea, Porthetria dispar,* and tussock moth.

The species was recorded again from Washington by Dodge (1956), who reared it from host cocoons near Colville. Studies in the Blue Mts. of northeastern Oregon (Mason 1976) revealed that almost half of all the parasites reared from host cocoons were this species. Based on his own observations and those of other authors, Mason speculates that significant host mortality may result from the stinging habit of the parasite. Because an egg is not always laid after the host is paralyzed, much unidentified pupal mortality may be attributable to the activity of this species. The dominance of *T. a. fulvescens* is also apparent from the comments of Tunnock et al. (1976), who found it to be the most common species reared from cocoons collected in an outbreak near Coeur d'Alene, Idaho [R-1]. Other sources mention this species at numerous sites in the Northwest and northern Rockies. Hopkins US file data record it from Rice, Wash., in 1947 (Hopkins US 21560 a-f) [INT]. It has been reared from hosts near Bellevue, Fairfield, Potlatch, and St. Maries, Idaho, in 1973 [R-1, R-4], and Volker et al. (1977 unpub.) reared it from collections made near Flathead Lake, Mont., in 1975 and 1976 [UI]; I identified the species from additional specimens that were collected in the same area in 1975 [R-1]. Collections of hosts near Okanagan Landing, in 1961, and near Ollala, B. C., in 1963, yielded this parasite (D. Evans, personal communication) [FIDS]. I have a single record of this species on a host collected near Malin, in south-central Oregon, in 1978 [PNW].

In the Southwest, it has emerged from host collections made in the Manzano Mts. in 1959 (Yasinski and Wheeler 1962 unpub.), and in the Sandia Mts., the same year (Rivas 1959 unpub.) [PM, PNW]. Dahlsten et al. (1977) also listed it from rearings of host cocoons in the central Sierras in the early 1970's [UC]. The dominance of this species is mentioned by Torgersen and Dahlsten (1978), and I included it in a key to tussock moth parasites (Torgersen 1977).

Theronia fulvescens (Cresson) Ichneumonidae

See *Theronia atalantae fulvescens* (Cresson).

Bathythrix latifrons (Cushman) Ichneumonidae

I have examined the specimen and host remains associated with a single individual that emerged from the cocoon of *Hyposoter* n. sp. collected near Burns, Oreg., in 1969 (Hopkins US 33269) [PNW]. Tussock moth were present at the collection site, and the *Hyposoter* species is the common one on that host. This hyperparasite is included in a key to 30 species of parasites of tussock moth; supplemental notes are also given (Torgersen 1977).

An unidentified species of *Bathythrix* was listed by Yasinski and Wheeler (1962 unpub.) as emerging from a host pupa collected in the Manzano Mountains, N. Mex., in 1959.

Gelis tenellus (Say) Ichneumonidae

This species occurs only sporadically in parasite material associated with tussock moth. I have examined and verified five specimens of this species, and four of them developed as hyperparasites. Dahlsten et al. (1977) recorded the species, which they believed to have been a secondary parasite, from El Dorado Co., Calif., in the central Sierras, in 1972 [UC]. A specimen collected near Burns, Oreg., in 1964, had emerged from a cocoon of the undescribed *Hyposoter* species that occurs on this host [PNW]. Another record from the same *Hyposoter* host comes from Modoc Co., Calif., where the primary host was being studied in 1966 (Hopkins US 64035) [PNW]. I determined a specimen that emerged from the cocoon of *Phobocampe pallipes,* collected from branches infested with tussock moth in an outbreak area near Silver City, Idaho, in 1976 [R-4]. The only case of primary parasitism I observed was a single specimen from a host collected near La Grande, Oreg., in 1973 (Hopkins US 33299C) [PNW].

Gelis sp. Ichneumonidae

I examined an unidentified species of *Gelis* that emerged from *Phobocampe pallipes* collected in an area infested with tussock moth near Burns, Oreg., in 1964 (Hopkins US 33268). The species is definitely not *G. tenellus* [PNW]!

Both of the preceding *Gelis* species are included in my treatment of tussock moth parasites (Torgersen 1977).

Mastrus sp. Ichneumonidae

This record is represented by a single rearing of an unidentified *Mastrus* that emerged from the puparium of *Carcelia yalensis* collected near La Grande, Oreg., in 1974 [PNW].

Gambrus canadensis burkei (Viereck) Ichneumonidae

According to Townes and Townes (1962), this parasite is mainly a California species. They record *H. oslari* as a host and mention a "tussock moth" host collected in the Santa Clara Valley, Calif. Other hosts are *Malacosoma californicum, Hemerocampa (= Orgyia) vetusa* (sic), and from *Phloeosinus* (Scolytidae), which they considered incorrect. No collection data are given for the *H. oslari* record shown above. *H. oslari* records from California before 1957 are, however, now known to have been *Orgyia pseudotsugata* (Eaton and Strubble 1957). The "Mono N.F." collection location should be Inyo National Forest in Mono County, Calif.; the outbreak was located near Mammoth Lakes from about 1935 to 1937 [AEI].

Dahlsten et al. (1970) erroneously recorded *O. pseudotsugata* as a new host for this parasite, evidently having missed the earlier record because of the confusion in host names. It was reared from larval and cocoon collections on study plots in northeastern California, in 1964 and 1975. Later, Dahlsten et al. (1977) discussed this species as one of the most common parasites reared during the course of their investigations in the El Dorado and Placer Counties area, Calif., from 1971 to 1973. It is a gregarious primary parasite that emerged from cocoons containing pupae or final instar larvae; about three progeny were produced per host. It was hyperparasitized by one gregarious form, *Monodontomerus saltuosus,* and by an unidentified solitary [UC]. Additional rearings and pinned specimens from 1970 [PNW] supplement the records of this species from hosts collected in El Dorado County, Calif.

G. c. burkei is included in a key to 30 species of common parasites of this host. A supplemental diagnostic description and brief biological notes are given (Torgersen 1977).

Conoblasta fumiferanae Viereck Ichneumonidae

See *Glypta fumiferanae* (Viereck).

Glypta fumiferanae (Viereck) Ichneumonidae

Balch (1930 unpub., 1932) records this species as *Conoblasta fumiferanae,* a parasite reared from host material collected at Jarbidge, Nev., and Weiser, Idaho, in 1929, and remarks on the appearance of its cocoon. *Conoblasta* is a synonym of *Glypta* (Krombein et al. 1979).

Campoplex sp. Ichneumonidae

See *Hyposoter* sp.

Casinaria limenitidis (Howard) Ichneumonidae

A single, pinned specimen and unpublished file data listing this species among a series of parasites reared from hosts collected near Placerville, El Dorado Co., Calif., in 1966, verify the record of this species on tussock moth [PNW]. At Aztec Peak, Ariz., in 1977, H. G. Paul collected three larval hosts from which this species emerged. The same season, he reared another individual from a host collected near Burns, Oreg. [PNW]. All the specimens were determined by R. W. Carlson.

Phobocampe clisiocampe (Weed) Ichneumonidae

According to D. Evans (personal communication), this species was reared from hosts collected in British Columbia near Ashcroft, Barnes Lake, Cascade, and Chase in 1949; near Jamieson and McLure in 1949; and near Cascade in 1953. To my knowledge, this is the first record of this species on tussock moth; another *Phobocampe, P. pallipes,* is usually the dominant species in southern portions of the host's range; see below.

Phobocampe pallipes (Provancher) Ichneumonidae

Mention of this species occurs rather infrequently despite the fact that it is a dominant parasite of the larval host. It was recorded by Balch (1932) under the replaced synonym *Hyposoter pallipes* (Townes 1969), who mentioned it casually. In an outbreak area near Coeur d'Alene, Idaho, in 1974, it was the third most abundant parasite of the 11 species recorded [R-1]. Mason (1976) states that *P. pallipes* was the dominant larval parasite in the Blue Mountains of northeastern Oregon in 1973 and 1974 [PNW]. It accounted for more than 90 percent of all larval parasitism! The species was captured in flight at the time of egg hatch in early June, and commonly thereafter through July.

Volker et al. (1977 unpub.) listed *P. pallipes* as a common parasite from hosts collected in former outbreak sites near Coeur d'Alene, Idaho, and Kamloops, B. C., in 1975 and 1976 [UI]. They remarked on its absence from their Flathead Lake, Mont., sites and believed it might not occur there. J. D. Ward (personal communication), however, evidently reared this parasite from hosts in the Flathead Lake infestations in 1975 [R-1]. Although Volker et al. reared numerous associated defoliators from trees infested with tussock moth, they found relatively few that had been parasitized by *P. pallipes* and surmised that this indicated preference for tussock moth. Other records of this species in Idaho are from Hailey where it was reared by J. C. Evenden in 1938 (Hopkins US 22025) [INT]; again near Coeur d'Alene, where M. J. Stelzer collected it in conjunction with evaluations of *Bacillus thuringiensis* spray tests against tussock moth in 1974 [PNW]; and near Silver City in 1976, when A. C. Valcarce obtained cocooned specimens of this parasite, which I later identified. Mason (1976), P. J. Shea (personal communication), and file data (PNW) indicate rearings of *P. pallipes* at numerous sites in the Blue Mountains in northeastern Oregon in the early and mid-1970's. D. Evans (personal communication) has records in British Columbia for this parasite from hosts near Otter Bay in 1948, and Cache Creek in 1967 [FIDS]. I also identified specimens collected near Kamloops, B.C., by J. D. Ward in 1976.

Evidence that *P. pallipes* occurs on this host in the Southwest is clearly demonstrated by its dominant representation in the larval parasite guild associated with tussock moth at some Aztec Peak study sites near Globe, Ariz., where R. R. Mason and I obtained it in collections from 1977 to 1979. We have also reared it from hosts collected near Burns, Oreg., in 1975 and 1977; near Malin, Oreg., in 1978; and near Placerville, Calif., in 1978 and 1979 [PNW].

Between the two *Phobocampe* species that occur on tussock moth, *P. pallipes* and *Phobocampe* n. sp., the former must be recognized as the dominant early larval parasite in the system. *Phobocampe* n. sp., however, appears to displace the dominance of *P. pallipes* in the northern part of the host's range, especially Idaho, British Columbia, and Montana. This hypothesis is alluded to by Torgersen and Dahlsten (1978) and Mason and Torgersen (1977 unpub.). *P. pallipes* is included in a key (Torgersen 1977) with brief diagnostic and biological notes.

Phobocampe n. sp. Ichneumonidae

This parasite was identified as a new species by R. W. Carlson on the basis of specimens from northeastern Oregon in 1973 and 1974 (Mason 1976), and from several sites in Idaho and near Flathead Lake, Mont., in 1975 and 1976 (Tunnock et al. 1976, Volker et al. 1977 unpub.). Tunnock et al. found it to be the most abundant parasite in an outbreak near Coeur d'Alene, Idaho, in 1974. The species was reared from all instars, but was most common from early ones [R-1].

I identified this species in large series of parasites reared in conjunction with evaluations of tussock moth spray tests conducted near La Grande, Oreg., in 1973 by P. J. Shea, and near Coeur d'Alene, Idaho, in 1974 by M. J. Stelzer. I also determined several specimens from hosts collected near Flathead Lake, Mont., in 1975 by J. D. Ward [R-1, PNW].

Volker et al. (1977 unpub.) made extensive collections of defoliators associated with tussock moth and determined that this *Phobocampe* species is primarily a parasite of geometrids, particularly when tussock moth is scarce. They recorded six species of geometrids as hosts: *Melanolophia imitata, Semiothisa signaria dispuncta, Lambdina fiscellaria lugubrosa, Nepytia freemani, Pero behrensarius,* and a *Eupathecia* species. They discuss detailed aspects of parasite oviposition behavior and host preference in relation to the role of *Phobocampe* n. sp. as a major early larval parasite of tussock moth. This species is included in a key to 30 species of parasites of this host (Torgersen 1977); a supplemental diagnostic description, as well as brief biological notes, are given. A forthcoming generic revision by R. W. Carlson will include a taxonomic description of this new species. See notes on *Phobocampe pallipes* in the previous section for other comments on this species.

McComb (1973 unpub.) names an undetermined species of *Phobocampe* as a known parasite of tussock moth in Washington and Oregon. In addition, he cites collection of pupae (= cocoons?) of this parasite on Mt. Emily near La Grande, Oreg. Subsequent parasite rearings by R. R. Mason and me in the same area, have produced only *P. pallipes* and the *Phobocampe* n. sp. listed above. In Torgersen and Dahlsten (1978), we mention a new species of *Phobocampe* from tussock moth and *Melanolophia imitata* in California (Dahlsten et al. 1976 unpub.); this may or may not be the same as the new species above.

Hyposoter annulipes (Cresson) Ichneumonidae

According to D. Evans (personal communication), this species was reared from hosts collected in British Columbia near Falkland in June 1948, and near Hedley and Oyama in 1954 [FIDS]. To my knowledge, this is the first record of this species on tussock moth.

Hyposoter n. sp. Ichneumonidae

Many references to this species as a parasite of tussock moth refer to it as *H. didymator* (Thunberg), which is a western Palearctic species. The *Hyposoter* at hand bears a great deal of similarity to *H. didymator,* but R. W. Carlson (personal communication) believes that it is a distinct, undescribed species.

Records concerning this widespread and rather common parasite of early larvae are unusual when compared with the other dominant parasites in the complex. Although most records of the common parasites from tussock moth go back to the early 1930's, the earliest, well-documented rearing of this *Hyposoter* is from 1965! Somehow, despite the now well-known dominance of the species in Oregon and California—and its cosmopolitan distribution throughout the host's range—it had been missed or gone unrecognized until rather recently. In Mathers (1949), a *Hyposoter* species is mentioned that was evidently one of the most commonly observed hymenopterous parasites in heavily infested stands in the Kamloops Forest District, B.C. This may have been a reference to *Hyposoter* n. sp. Dahlsten et al. (1977) and D. L. Dahlsten (personal communication) indicate that the species appeared consistently in rearings from former outbreak sites in Modoc Co. (1965, 1966, 1976); El Dorado Co. (1971, 1972, 1974, 1976); and Placer Co. (1971-73), Calif. [UC, PNW].

Both *Hyposoter* n. sp. and *H. fugitivus* were reared by Dahlsten et al. (1977), who determined that this species was most commonly reared from fourth instar hosts that had been attacked in one of the earlier instars. A bimodal emergence pattern for the two *Hyposoter* species suggested to these authors that emergence at different times might act to ameliorate competition between the two parasites. They list *H.* n. sp. as a host for *Ceratosmicra campoplegicis.* Rearings containing hosts collected in an infestation near Coeur d'Alene, Idaho, in 1974, indicated that first instars could be parasitized. Subsequent rearings of this parasite are recorded by Volker et al. (1977 unpub.), who obtained it at Coeur d'Alene in 1975 and 1976, and at Emida Peak, Idaho, in the same years [UI]. I have examined specimens collected by M. J. Stelzer in conjunction with evaluations of chemical spray tests near Coeur d'Alene in 1974. I verified specimens from hosts collected in the environs of Flathead Lake, Mont., in 1975 and 1976, by Volker et al. (1977 unpub.) and by J. D. Ward. Among other rearings of parasites from various locations in the West, I have identified *Hyposoter* n. sp. from:

Locality	Source
Near Malin, Oreg.	Collected in 1975, 1977, and 1978 by R. R. Mason and H. G. Paul [PNW].
Near Ft. Klamath, Oreg.	Collected in 1975-77 by R. R. Mason and H. G. Paul [PNW].
Near La Grande, Oreg.	Collected in 1973 and 1974 by R. R. Mason and H. G. Paul, and in 1976 by Mason [PNW].
Near Chiloquin, Oreg.	Collected in 1977 and 1978 by R. R. Mason and H. G. Paul [PNW].
Near Lakeview, Oreg.	Collected in 1966, 1975, and 1977-79 by R. R. Mason and H. G. Paul [PNW].
Near Globe, Ariz.	Collected in 1979 by R. R. Mason and H. G. Paul [PNW].
Near Alturas, Calif.	Collected in 1977 and 1978 by R. R. Mason and H. G. Paul [PNW].
Near Placerville, Calif.	Collected in 1978 and 1979 by R. R. Mason and H. G. Paul [PNW].
Sandia Mts., N. Mex.	Collected in 1959 by A. M. Rivas [PNW].
Near Kamloops, B. C.	Collected in 1976 by J. D. Ward [R-1].

We listed this species—as *H. didymator*—as a prominent member of the larval parasite guild (Torgersen and Dahlsten 1978), and I included it as *H.* n. sp. in a key to tussock moth parasites, with supplemental diagnostic and biological notes (Torgersen 1977).

Hyposoter fugitivus (Say) Ichneumonidae

This *Hyposoter* species appears to replace *H.* n. sp. in dominance in southern portions of the host range, particularly in California and southern Oregon. Dahlsten et al. (1977) recorded *H. fugitivus,* as *H. f. pacificus,* from fourth-instar hosts that had been parasitized in earlier instars. They found that this species was one of the four most common parasites in the larval guild in their central Sierra plots. Personal communication from D. L. Dahlsten indicates records of this species in California from El Dorado County near Placerville in 1971, 1972, 1976; from Modoc County at Tom's and Corral Creeks in 1966 and 1976; from Tuolumne County at Strawberry Peak and Upper Hulls Meadow in 1976; and from Calaveras County on Baily Ridge in 1976.

In our own studies (Mason and Torgersen 1977 unpub.), we recorded the species from south-central Oregon near Ft. Klamath in 1976; we also reared it in 1978 (unpub. data on file at PNW). Our records show it from Corral Creek in Modoc County in 1966 and 1971-73, and near Placerville in El Dorado County in 1966, 1970-73, 1978, and 1979 [PNW]. I have examined and verified or determined specimens from the vicinity of Flathead Lake, Montana, in 1975 and 1976, collected by Volker et al. (1977 unpub.) and J. D. Ward [UI, R-1], and near Silver City, Idaho, in 1976 by M. M. Ollieu [R-4].

This species is mentioned in Torgersen and Dahlsten (1978), and it appears in my key treatment and supplemental notes on tussock moth parasites (Torgersen 1977).

Hyposoter pallipes Provancher — Ichneumonidae

See *Phobocampe pallipes* (Provancher).

Mesochorus uniformis Cresson — Ichneumonidae

This record is represented by a single female that emerged from the cocoon of *Phobocampe pallipes.* The host was collected at Corral Creek, Modoc Co., Calif., in 1966 [PNW].

Mesochorus vittator (Zetterstedt) — Ichneumonidae

This species is known to be associated with the tussock moth as a hyperparasite only. Two specimens, one each from cocoons of *Phobocampe* n. sp. and *Hyposoter* n. sp., were reared from hosts collected near Coeur d'Alene, Idaho, in 1974 by M. J. Stelzer [PNW]. Host material was being collected in conjunction with evaluations of chemical spray tests. We made brief mention of the hyperparasitic habit of this species in Torgersen and Dahlsten (1978).

Mesochorus sp. — Ichneumonidae

Tunnock et al. (1976) listed a specimen of *Mesochorus* reared from an unidentified *Phobocampe* cocoon collected near Coeur d'Alene, Idaho, in 1974 [R-1]. Personal communication with Tunnock verifies that the host was actually *P.* n. sp., but the specific identity of the *Mesochorus* remains undetermined. I identified to genus only specimens reared from both *Phobocampe pallipes* and *Phobocampe* n. sp. obtained from host collections near La Grande, Oreg., in 1973 by P. J. Shea [PSW]. In a key to tussock moth parasites, I identify this hyperparasite to genus only (Torgersen 1977).

Orgichneumon calcatorius (Thunberg) — Ichneumonidae

This large, black, rather striking ichneumonid is represented in my records by very few citations. I identified specimens collected from hosts collected near Potlatch, Idaho, in 1973, but I have no more detail on the record [R-1]; the specimens had been formerly identified as *Ichneumon* sp. Mason (1976) only lists the species as having been reared from hosts collected in the Blue Mountains in northeastern Oregon in 1973 and 1974. I included it in my key to tussock moth parasites (Torgersen 1977).

Chalcidoidea

Monodontomerus dentipes (Dalman) Torymidae

This species was listed as a parasite of tussock moth in the northern Rocky Mountains (Bedard 1938) and in New Mexico by Jennings (1975 unpub.). Subsequent determinations of *Monodontomerus* specimens from urban Los Alamos, Ruidoso, and Santa Fe where Jennings collected, indicate the presence of both *M. minor* and *M. saltuosus* at these sites. Peck (1963) questioned the validity of former records of *M. dentipes* on tussock moth; therefore, I'm inclined to believe that the above records are either misidentifications of *M. saltuosus* or *minor,* or that they represent contaminants or hyperparasites in the rearings. See *M. saltuosus* and *M. minor.*

Monodontomerus minor (Ratz.) Torymidae

Several specimens of this species were identified for me by E. E. Grissell. The specimens emerged as gregarious primary parasites from host cocoons collected in urban areas of Los Alamos and Santa Fe, N. Mex., and at Lowry Air Force Base, Denver, Colo., by D. T. Jennings in 1975 [PNW].

Monodontomerus saltuosus Grissell Torymidae

Dahlsten et al. (1977) listed this species as a gregarious secondary parasite emerging from field-collected cocoons only; it was never associated with prespinning larvae. The primary parasite *Gambrus canadensis burkei* was its host in the northern Sierras collection sites [UC]. I obtained this species in our rearings of cocooned hosts collected in the same area near Placerville, Calif., in 1978. Eleven adults emerged from a cocooned host pupa that had the remains of an ephialtine primary parasite. The cephalic structures appeared to be those of *Ephialtes componotus,* which was common in rearings from the sites examined.

Other specimens of *M. saltuosus* from the California sites represent rearings conducted by C. G. Thompson in 1970, and by R. R. Mason in 1978 and 1979. I also have specimens from hosts collected by D. T. Jennings in Santa Fe, N. Mex., in 1975 [PNW]. In additional rearings from more recent study sites near Ft. Klamath, Oreg., a single cocoon collected in 1979 produced *M. saltuosus.*

Monodontomerus sp. Torymidae

Undetermined species of *Monodontomerus* were recorded from hosts collected near Colville, Wash., in 1956 (Hopkins US 15816A) [INT], and in the Manzano Mountains, N. Mex., in 1959 by Yasinski and Wheeler (1962 unpub.) [RM]. I keyed this parasite to genus only in my treatment of tussock moth parasites (Torgersen 1977).

Microdontomerus sp. Torymidae

According to file data (Hopkins US 19803), two females were successfully reared from four parasite larvae dissected from a host pupa collected in 1930 by D. DeLeon near Northport, Wash. [INT]. A. B. Gahan, who identified the specimens, believed they were a new species.

Perilampus hyalinus Say Pteromalidae

According to D. Evans (personal communication), this species was reared from hosts collected in British Columbia near Chase in 1948, and near Vernon in 1963. This appears to be the first record of this species on tussock moth. I examined a specimen of *P. hyalinus* that emerged from an *"Apanteles"* associated with tussock moth collected by J. D. Ward near Flathead Lake, Mont., in 1976 [R-1].

The range of hosts given by Peck (1963) suggests that this species may be capable of hyperparasitizing several primary parasites that spin cocoons, such as *Meteorus, Hyposoter,* or *Phobocampe.*

Pachyneuron sp. Pteromalidae

Jennings (1977 unpub.) listed an undetermined *Pachyneuron* from tussock moth collected near Santa Fe., N. Mex., in 1975. This specimen was identified by G. Gordh, who had previously misidentified a *Pachycrepoideus* species that I had reared from a tachinid primary parasite of tussock moth as a *Pachyneuron* species. Whether or not to attribute the *Pachyneuron* collected by Jennings to tussock moth is uncertain.

Pachycrepoideus vindemiae (Rondoni) Pteromalidae

This species was listed as a hyperparasite under the name *Pachyneuron* in Torgersen and Dahlsten (1978). The specimens upon which the above record is based have recently been redetermined as *P. vindemiae* by E. E. Grissell. This is a hyperparasite that emerges from the puparium of *Carcelia yalensis.* Specimens upon which this record is based were reared from puparia I collected near La Grande, Oreg., in 1974 [PNW].

Catolaccus aeneoviridis (Girault) Pteromalidae

Hopkins file data [INT] indicated that this species was reared as an apparent hyperparasite from host material collected near Colville, Wash., by H. R. Dodge in 1959 (Hopkins US 15824). No indication is given what the primary parasite may have been.

Pteromalus hemileucae Gahan Pteromalidae

According to Yasinski and Wheeler (1962 unpub.), this species emerged from a collection of host pupae obtained in the Manzano Mountains, N. Mex., in 1959. The record may represent a contaminant in the rearing material. Peck (1963) and Krombein et al. (1979) indicate that the only known host for this parasite is *Hemileuca olivae* Ckll., which feeds on grasses and some cultivated crops in the Southwest.

Habrocytus sp. or spp. Pteromalidae

I have located only two records of this parasite on tussock moth. It was reared from hosts collected near Rice, Wash., by P. C. Johnson in 1947, and near Deer Park, Wash., by H. R. Dodge in 1956, but details of the records are not available [INT]. I have verified the record from Placerville, Calif., in 1970, based on specimens that I have examined in our own collections [PNW].

Because I have not seen the specimens collected in Washington, I do not know whether they are one or two species. Species in this genus are usually, though not exclusively, hyperparasites.

Mesopolobus sp. 1 Pteromalidae

This parasite occurs on tussock moth only rarely; I know of only two records. Three specimens were reared from a host egg mass collected near Corral Creek, Modoc Co., Calif., in 1966 by R. R. Mason, who was conducting life-table studies there. I suspected the record was in error and examined the specimens. During studies of egg parasites on this host near Placerville, Calif., in 1977, Mason and I obtained two specimens from a laboratory-produced egg mass that was one of a score that had been placed in the field to assess parasitization. E. E. Grissell made the determinations upon which this record is based.

Mesopolobus sp. 2 Pteromalidae

This gregarious species was obtained from host cocoons collected by H. G. Paul near the height of the Blue Mountains outbreaks near La Grande in northeastern Oregon in 1973 [PNW, USNM]. According to E. E. Grissell (personal communication), who identified the specimens, this may be an undescribed species.

Mesopolobus sp. 3 Pteromalidae

This record is represented by a single specimen that emerged from the cocoon of the primary parasite *Hyposoter* n. sp. [PNW]. The cocoon was collected from foliage infested with tussock moth obtained near Burns, Oreg., in 1964 by V. M. Carolin. The Hopkins US card (65226) indicates, in error, that the host is *H. didymator.*

Tritneptis hemerocampae Viereck Pteromalidae

Determination records confirm a rearing of this parasite as *T. hemerocampe* (sic) (Girault) from a host pupa collected near Placerville, Calif., in 1970 [PNW].

Dibrachys cavus (Walker) Pteromalidae

The earliest, though casual, record of this parasite on tussock moth was published by Bedard (1938), who only indicated that the species represented was from the northern Rockies. According to Hopkins US records (19956), A. B. Gahan identified a specimen reared from a host cocoon collected near Northport, Wash., by D. DeLeon in 1930. Gahan called it *D. boucheanus* (Ratz.), which is listed as a synonym for *D. cavus* in Peck (1963).

Jennings (1975 unpub.) listed an unidentified *Dibrachys* as a parasite of this host collected in urban Ruidoso and Santa Fe, N. Mex., in 1974 and 1975. Because I have identified specimens of *D. cavus* from host pupae collected by Jennings at Los Alamos, and *cavus* is the only *Dibrachys* from tussock moth, I am assuming that this is the species. I included this species in my treatment of tussock moth parasites (Torgersen 1977).

Hypopteromalus percussor Girault — Pteromalidae

Krombein and Burks (1967) recorded this species from a campoplegine primary parasite reared from *Hemerocampa (= Orgyia) pseudotsugata* and other Lepidoptera in Nevada and New Mexico. The campoplegine referred to was likely a *Phobocampe* or *Hyposoter* species, both of which occur as primary parasites on this host in the Southwest. The only other specific host reference I find for this hyperparasite of tussock moth is by Dahlsten et al. (1977), who reared it from *Bracon xanthonotus* associated with hosts in El Dorado Co., Calif., in the early 1970's [UC]. I have examined *H. percussor* from tussock moth collected in 1970 near the same sites as used by Dahlsten et al. Neither the specimens nor the data associated with them (Hopkins US 63730, 63731) clarify their host relationships [PNW]. This parasite is listed by Yasinski and Wheeler (1962 unpub.) from outbreak areas in the Manzano Mountains, N. Mex. in 1959. I identified an extensive series of this species from hosts collected near Troy, Oreg., by R. L. Furniss and W. J. Buckhorn in 1947 (Hopkins US 33252-D) [PNW].

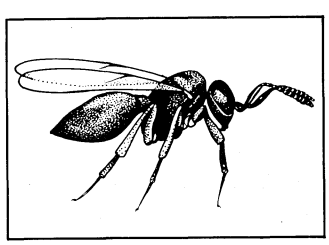
Hopkins US file data indicate rearings of an unidentified *Hypopteromalus* near Deer Park, Wash., in 1956 (Hopkins US 15825) [INT]. This material was reared by Dodge (1956) [INT]. I included this species in my key and diagnostic treatment of tussock moth parasites (Torgersen 1977).

Ceratosmicra campoplegicis Burks — Chalcididae

A single specimen of this species was reared by Dahlsten et al. (1977) from the cocoon of *Hyposoter* n. sp. obtained at one of their California study sites [UC]. The authors stated that it is also known from another undetermined campoplegine as well as two braconids, *Apanteles koebelei* Riley and *Perilitus coccinellae* Shrank. Other *Glyptapanteles, Phobocampe,* and *Hyposoter* species are likely hosts for this hyperparasite associated with tussock moth.

Ceratosmicra meteori Burks — Chalcididae

I examined the specimen that was collected in the Sandia Mountains, N. Mex., in 1959, and identified by B. D. Burks [RM]. Accompanying it were two pinned cocoons bearing the same Hopkins US number as the *C. meteori* specimen, and which were, without doubt, those of *Hyposoter* n. sp. Both cocoons had emergence holes unlike those produced by *H.* n. sp. at emergence, which I assume were those of *C. meteori.*



Brachymeria ovata ovata (Say) Chalcididae

This species, given as *Chalcis ovata,* was reared from larvae identified as *Notolophus oslari* Barnes collected in Yosemite National Park, Calif. (Burke 1906). Taxonomic changes have synonymized *C. ovata* with *Brachymeria* (Peck 1963), and *N. oslari* with *Orgyia pseudotsugata* (Eaton and Strubble 1957). This record is rather obscure, and Dahlsten et al. (1970) were evidently unaware of it when they reported this species as a new parasite record for this host. They reared it from collections containing larvae and cocoons in Lassen Co., Calif., in 1964 and 1965. They also listed the species from El Dorado and Placer County sites in 1971 and 1972, where it emerged from hosts collected as cocoons (Dahlsten et al. 1977) [UC]. Yasinski and Wheeler (1962 unpub.) reared the species from host cocoons collected in the Manzano Mountains of New Mexico in 1959. In urban Santa Fe, D. T. Jennings (personal communication) obtained it in rearings in 1974 and 1975.

I have examined specimens or verified rearings of this species from near Corral Creek, Modoc Co., Calif., in 1966; in El Dorado Co. near the sites used by Dahlsten et al. (1977) in 1970, 1978, and 1979; and in south-central Oregon near Ft. Klamath in 1976 and 1979 [PNW].

The collection data presented here imply that B. *ovata ovata* may be a species that is confined to southern portions of the host range. I included the species in a key to tussock moth parasites (Torgersen 1977).

Arhopoideus n. sp. nr. *piceae* Erdos Encyrtidae

A report by Jennings (1975 unpub.) lists this species from tussock moth in New Mexico [PNW]. Because members of this genus usually attack species of Coccidae, I believe this report probably represents a contaminant in the host collection.

Copidosoma sp. Encyrtidae

According to D. A. Ross (personal communication), this parasite caused 2 percent mortality of host eggs collected near Osoyoos, B. C., in May 1973 [FIDS].

Aphycus sp. Encyrtidae

Jennings (1975 unpub.) lists an unidentified *Aphycus* species as a parasite on this host. Because members of this genus usually parasitize species of Coccidae, it may represent a contaminant inadvertently included in the host collection.

Ooencyrtus sp. Encyrtidae

An unidentified species of *Ooencyrtus* was reared from host eggs collected at Polson near Flathead Lake, Mont., in 1975 by S. Tunnock (Hopkins US 59202) [R-1]. Also, this appears to be the same species reared by T. Gray and R. Shepherd (personal communication), from egg masses collected near Kamloops, B. C., in 1975. L. Masner (personal communication) suspects that this species may be acting as a hyperparasite utilizing *Telenomus.*

Anastatus sp. Eupelmidae

This is a rare parasite of tussock moth. It emerges from the host egg, and the only specimen I have seen appeared among a score of *Trichogramma minutum* that emerged from eggs collected at Mill Canyon near Fairfield, Idaho, in 1976 by A. C. Valcarce [R-4]. The only other record I know of associated with tussock moth is in Yasinski and Wheeler (1962 unpub.), where they list *Anistatus* (sic) sp. from eggs collected in the Sandia Mountains in 1959 [RM].

Euplectrus sp. Eulophidae

Tunnock et al. (1976) state that a single specimen was reared from a second- or third-instar host collected in an infestation southeast of Coeur d'Alene, Idaho, in 1974 [R-1]. This is the only record of this parasite on tussock moth that I am aware of.

Elachertus sp. prob. *cidariae* Ashmead Eulophidae

At the time E. E. Grissell determined the specimens comprising the records below, he indicated *E. cidariae* is an Eastern species, normally from geometrids, and that it differed from our Western species by having yellow antennae. He stated that he did not know if that difference was sufficient justification to create a new name for the specimens at hand.

I have several definite host records for our Western species, all of which are from California. The most complete records come from sites near Placerville where I collected early tussock moth larvae for life-table data in 1978. The parasites emerged from second instar hosts in six cases and from a third instar in a single case; one to five larvae emerged per host (Hopkins US 65285, 65286) [PNW].

Determinations of this species from Corral Creek in Modoc Co., Calif., in 1966, and near Burns, Oreg., in 1978, verify its presence farther northward and suggest its range extends well into Oregon [PNW]. The description given by Dahlsten et al. (1977) suggests that the *Tetrastichus* species they recorded may actually have been the *Elachertus* treated here [UC]. The sites used in their 1971 and 1972 studies were very close to where I sampled in 1978.

At least one of the *Tetrastichus* species appearing in the appendix table by Torgersen and Dahlsten (1978) is this *Elachertus* species. The *Tetrastichus* species from host larvae that I refer to in Torgersen (1977) is also this species. See *Tetrastichus* spp. below.

Elachertus hyphantriae Crawford Eulophidae

Two specimens were reared from a single larva collected as an early instar near Burns, Oreg., by H. G. Paul in 1977 (Hopkins US 65228) [PNW]. Krombein et al. (1979) list another *Orgyia, O. definita* (Pack.) as a host for this parasite.

Baryscapus sp. Eulophidae

See *Tetrastichus (Baryscapus)* sp. nr. *pandora* Burks.

Tetrastichus coerulescens (Ashmead) Eulophidae

According to Hopkins US file data [INT], this species was reared as an apparent hyperparasite from host material collected by H. R. Dodge near Colville, Wash., in 1956 (Hopkins US 15823). Host data in Krombein et al. (1979) suggest that *Apanteles* (prob. = *Cotesia), Bracon, Dibrachys, Hyposoter,* or *Meteorus* species could serve as the primary hosts for *T. coerulescens.*

Tetrastichus (Baryscapus) n. sp. nr. *pandora* Burks Eulophidae

All of the records or specimens of this species that I have seen are from New Mexico, where at times it shares dominance with *Telenomus californicus,* the most common egg parasite throughout the host's range. Some confusion surrounds the identity of this *Tetrastichus* species, which G. Gordh and E. E. Grissell (personal communication) believe is an undescribed species. For a time, this species was placed in *Baryscapus,* which formerly had generic status but is now considered a subgenus.

Yasinski and Wheeler (1962 unpub.) refer to a *Tetrastichus* species reared from host eggs collected in the Sandia Mountains, N. Mex., in 1959 [RM]. I suspect that their record actually refers to the species here. Specimens listed as *Baryscapus* sp. by Jennings (1977 unpub.), and which were reared from host eggs collected at sites in urban Los Alamos, Ruidoso, and Santa Fe, N. Mex., in 1974 and 1975, are this new species [PNW]. I have also examined specimens of it reared from host eggs collected in Medio Dia Canyon, N. Mex., in 1977 and 1978 (Sower and Torgersen 1979).

This species is very distinctive in appearance, especially the males, and it is included under *Tetrastichus* spp. in my treatment of tussock moth parasites (Torgersen 1977); we mention it in passing in Torgersen and Dahlsten (1978).

Tetrastichus sp. Eulophidae

In our collection we have a single specimen of *Tetrastichus* reared from a host cocoon collected from an urban tree in Los Alamos, N. Mex., by D. T. Jennings in 1975. According to E. E. Grissell (personal communication), the specimen is distinct from the *Tetrastichus (Baryscapus)* n. sp. nr. *pandora* from host eggs, but the specimen was in poor condition and could not be determined further (Hopkins US 37373-F) [PNW]. I have tentatively identified a specimen of *Tetrastichus,* also reared from a host cocoon, collected near Malin, Oreg., in 1978 [PNW].

Tetrastichus spp. Eulophidae

Several misidentifications may have incorrectly relegated some specimens reared from early instar hosts to this genus. Sometimes I have seen the specimens in question and resubmitted them for identification. In those instances, they were actually an *Elachertus* species, probably *cidariae* Ashmead according to E. E. Grissell (personal communication), and not *Tetrastichus* as originally determined.

I believe the *Tetrastichus* species reared by Dahlsten et al. (1977) may actually have been *Elachertus;* see *Elachertus* sp. prob. *cidariae.* The *Tetrastichus* spp. listed in the appendix of Brookes et al. (1978) represent a *Tetrastichus (Baryscapus)* sp. reared from host eggs, one or two species of *Elachertus* from larvae, and a *Tetrastichus* from pupal hosts.

Pediobius sp. Eulophidae

I have specimens and determination records for several series of this species reared from host egg masses collected by D. G. Holland at Medio Dia Canyon, Sandoval Co., N. Mex., in 1977 (Hopkins US 65291) [PNW, USNM]. Another rearing is recorded by Jennings (1975 unpub.), who collected on urban trees at Los Alamos, Ruidoso, and Santa Fe, N. Mex., in 1974. No host stage is indicated. According to D. Evans (personal communication), this species was reared from host cocoons collected near Okanagan Landing and Vernon, B. C., in 1961 [FIDS]. Peck (1963) indicates that members of this genus may be primary, secondary, or tertiary parasites.

Chrysonotomyia sp. Eulophidae

Hopkins US file data (65227a) [PNW] indicate a rearing of three specimens from tussock moth larvae collected near Silver City, Idaho, by M. M. Ollieu in 1976 [PNW]. Larval collections were being made in connection with evaluations of virus spray tests. *Chrysonotomyia* now contains all species formerly referred to as *Achrysocharella* Girault (Yoshimoto 1978) and *Achrysocharis* Girault (Boucek 1977). The hosts of the Nearactic *Chrysonotomyia* include leaf-mining, leaf-rolling, leaf-tying Lepidoptera, leaf-mining Diptera, and tenthredinoid Hymenoptera (Yoshimoto 1978).

Trichogramma californicum Nagaraja and Nagarkatti Trichogrammatidae

The holotype male for this species was reared from host eggs collected near Alturas, Calif., in 1967 (Nagaraja and Nagarkatti 1973) [USNM]. In the taxonomic treatment containing the new species description, the authors include a key to the New World species. About the same time that the holotype male was collected, Dahlsten et al. (1970) reared the species, as *T. californica* (sic), from egg masses collected during the 1964-1965 outbreak near Corral Creek, Modoc Co., also in far northern California [UC]. I made mention of this record as *T. californica* (sic) in Torgersen (1977), and we indicate its presence in California in Torgersen and Dahlsten (1978).

Trichogramma minutum Riley Trichogrammatidae

This species is widespread and appears throughout the range of the host. It does not commonly contribute a major portion to egg parasitization, so would not be considered a dominant species in the guild attacking eggs. Both Tunnock et al. (1974) and Mason (1976) found that it contributed only a small percentage to total egg parasitization during outbreaks of tussock moth in northern Idaho and northeastern Oregon in the early 1970's. Later, Tunnock (1975 and personal communication) and Tunnock et al. (1975) observed the same pattern at outbreak sites in the Lower Flathead River Valley, Mont.

The earliest record of the species on tussock moth appears in Balch (1930 unpub.), who stated that a large number of eggs were parasitized by *T. minuta* (sic) at Jarbidge, Nev., Weiser and New Meadows, Idaho, and Northport, Wash., in 1929. Some masses were nearly 20 percent parasitized at the Northport site. The author illustrated parasitized eggs, the adult male, and the female antenna, and commented that 4 to 11 parasites emerged per host egg. Balch's (1932) publication was actually less informative than the well-illustrated and more detailed unpublished report. Balch determined that *T. minutum* was responsible for greater parasitization than *Telenomus californicus.*

Mention of the species on this host does not appear in the literature again until Dodge (1956) reported a "tiny, gregarious egg parasite" from an outbreak area near Colville, Wash., and Orofino, Idaho, in 1955. The species is not identified, but I am certain it is *T. minutum,* which is the only egg parasite in the northern part of the host's range that produces several progeny per host egg.

According to D. A. Ross and D. Evans (personal communication), 11 to 20 percent parasitization by this species was observed near Winfield and Osoyoos, B.C., in 1973, during the third year of an outbreak. A further record was from Otter Lake, B. C., in 1962 [FIDS]. In rearing studies conducted by R. F. Shepherd, T. Gray, and me, we determined that parasitization by this species was 0.7 and 9.5 percent among eggs collected near Kamloops, B. C., in 1975 and 1976, respectively [PNW]. In 1976, the incidence of *Telenomus californicus* also was extremely low.

Other Northwest records for this parasite that I have verified or interpreted from unpublished data are: Troy, Oreg., in 1949 [PNW]; Riggins, Idaho, in 1974 [R-1]; Coeur d'Alene, Idaho, in 1975 (Hopkins US 59201 and Gittins et al. 1975 unpub.) [INT, UI]; and Mill Canyon near Fairfield, Idaho, in 1976 [R-4].

Dahlsten et al. (1977) reported that they reared both *Trichogramma minutum* and *T. californica* (sic) from egg masses collected in northern California in 1964 and 1965, but that they did not obtain it in rearings from the central Sierra Nevadas during their studies there from 1971 to 1973. I have a Hopkins US record (64136) for this species from near Alturas in northern California where it was reared in 1965.

A single record from host eggs collected in the Sandia Mountains, N. Mex., is apparently reported in two unpublished reports, by Yasinski and Wheeler (1962 unpub.) and by Rivas (1959 unpub.). We comment briefly on the geographical distribution and biology of this species in Torgersen (1977) and Torgersen and Dahlsten (1978).

Proctrupoidea

Telenomus californicus Ashmead — Scelionidae

This solitary, ubiquitous egg parasite is clearly the dominant species in the entire complex associated with the host throughout its range. *Orgyia pseudotsugata* is apparently the only host for this parasite. In Muesebeck et al. (1951), *Stilpnotia salicis* (L.) was given as a host in addition to tussock moth. In the latest edition of the Catalog of the Hymenoptera (Krombein et al. 1979), however, that host has been deleted. According to N. F. Johnson (personal communication), the original *S. salicis* record was based on a misidentification of the parasite.

Based on a subjective appraisal of the literature, the earliest record that refers to *T. californicus* on tussock moth appears in Hopkins (1906). In the minutes for a meeting of the Entomological Society of Washington late in 1906, A. D. Hopkins is reported to have stated that he reared parasites from egg masses of *Notolophus oslari* collected near Colorado Springs, Colo., in June of 1906. *N. oslari* from that geographic area is now known to have been *O. pseudotsugata* (Eaton and Strubble 1957). Although the species of parasite was not known, I believe the record refers to *T. californicus.* The species is known from as close as Denver (Averill 1976) [R-2, PNW], and the late collection date suggests that this was the parasite. When R. E. Balch and his associates studied tussock moth in the early 1930's, they found this parasite present, but not as the dominant egg parasite. The species was undetermined, but based on the descriptive and illustrative material given in Balch (1930 unpub., 1932), I surmise that the species was *T. californicus.* This conclusion was verified by N. F. Johnson (personal communication), who examined the specimens reared from eggs collected by Balch at Weiser, Idaho, in 1929. According to notes by Balch on Hopkins US 18883, he found dead adults and pupae of *T. californicus* within eggs that were still in a dead host pupa; most of the other eggs had parasite holes. Specimens were also collected from host egg masses from Jarbidge, Nev., and Northport, Wash., in the same year.

Since the work of Balch (1932), this egg parasite has appeared sporadically at many Idaho locations: near Moscow in 1947 [R-1]; near Atlanta and Fairfield in 1963 and 1973, respectively [R-4] (A. C. Valcarce, personal communication); near Potlatch, Riggins, and Coeur d'Alene in 1974 [R-1] (Tunnock et al. 1974; S. Tunnock, personal communication); and DeLamar [USNM] (N. F. Johnson, personal communication). The two other records from Idaho that I interpret to be *T. californicus* appear in Volker et al. (1977 unpub.), who reared a scelionid from host eggs collected near Moscow and Rupert in 1975 and 1976.

Other records from the northern portions of the host range include those of Tunnock (1975) and J. D. Ward (personal communication), who reared *T. californicus* from host eggs collected in the Lower Flathead River Valley in 1974 and 1975 [R-1]. Ward (personal communication) also reared this parasite from hosts collected near Kamloops, B. C., in 1976 [R-1]. Rearing records examined for me by D. A. Ross and D. Evans (personal communications) indicate that a single specimen of *Telenomus* species was reared from host eggs collected near Osoyoos in 1973; specimens were more commonly reared from collections near Olalla in 1954 and 1955, and near Otter Lake in 1961. The Olalla infestation was rather light in 1954 and 1955, and it collapsed after a virus epizootic in 1956. In that year, parasitization by an undetermined *Telenomus* ranged from 7 to 54 percent, with a mean of 26 percent for all plots examined. I believe these *Telenomus* records in British Columbia to be *T. californicus.*

During an outbreak period in the mid-1940's an unidentified *Telenomus* was reared from egg masses collected near Troy in northeastern Oregon. When host studies were reinitiated during the Blue Mountains outbreaks in the early 1970's, this parasite was the primary egg parasite. It was present in all the egg masses collected in the spring of 1974, and caused 35 percent egg mortality (Mason 1976). In other studies, in south-central Oregon from 1974 through 1979 (Torgersen and Ryan 1981, Mason and Torgersen 1978 unpub.), we found that spring parasitization was consistently high and caused 14 to 62 percent egg mortality. Parasitization was about 16 and 31 percent among eggs collected near Alturas and Placerville, Calif., in 1977. Correspondingly high parasitization was also reported by Wickman et al. (1973b), who alluded to parasitization by an unidentified *Telenomus* that was capable of destroying all the host eggs in individual masses and up to half the eggs in a stand. The *Telenomus* they refer to can only be *T. californicus!* Similarly, Dahlsten et al. (1977) observed heavy parasitization in their El Dorado, Calif., collection sites in 1971 and 1972. Parasitization more than doubled, going from about 17 percent in 1971 to more than 40 percent in 1972. Another California record indicated extremely low parasitization at a Modoc Co. site in 1976 (Dahlsten et al. 1976 unpub.). Tunnock et al. (1974) and Tunnock (1975) identified *T. californicus* as the most abundant egg parasite obtained in their studies, but recorded very low parasitization. Their collections were made in the fall, however, before the bulk of parasitization would have occurred. We now know that the main oviposition period for this parasite is in late spring just before host egg hatch (Torgersen and Ryan 1981).

In the Southwest, Averill (1976) reported parasitization of about 10 percent among eggs collected in the Denver, Colo., area in 1976. Also, although the records were not published, this species was evidently reared from hosts collected in the Sandia Mountains, N. Mex., in 1959 (Rivas 1959 unpub., Yasinski and Wheeler 1962 unpub.). Other sites in New Mexico from which this parasite has been recovered are in urban areas of Los Alamos, Ruidoso, and Santa Fe (Jennings 1975 unpub.) [PNW]; these sites were studied in 1974.

We discussed the importance of *T. californicus* briefly in Torgersen and Dahlsten (1978), and I included it in a key to tussock moth parasites. In Ryan et al. (1981) and Torgersen and Ryan (1981), we examined the reproductive and field biology of this parasite.

Telenomus coelodasidis Ashmead — Scelionidae

Balch (1932) indicated rearings of *Telenomus coelodisidis* (sic) from eggs apparently collected near Weiser, Idaho, in 1929. According to P. M. Marsh (personal communication), this was probably not a valid record, because Krombein et al. (1979) list only *Schizura leptinoides* (Grote) and *Heterocampa guttivitta* (Wlkr.) as hosts of this parasite.

Telenomus coloradensis Crawford — Scelionidae

Muesebeck et al. (1951) recorded *Hemerocampa oslari* as a host of this species collected near Colorado Springs, Colo. The name *oslari,* although properly referring to the Colorado population of *O. leucostigma* in a subspecific sense, has at times been used for Colorado specimens of both *O. leucostigma* and *O. pseudotsugata* (Ferguson 1978, p. 86). *O. pseudotsugata* is the more common of the *Orgyia* there; but whether this record should be attributed to it is still uncertain. This conclusion is based on personal communication with D. C. Ferguson. In Krombein and Burks (1967), the tussock moth host is given as *Hemerocampa pseudotsugata,* with the range as Idaho and Washington. Krombein et al. (1979) give both *O. oslari and* O. *pseudotsugata* as hosts.

Hopkins file data [INT] indicate that nearly a hundred specimens of this species were reared from host egg masses collected near Spring Valley, Wash., by H. R. Dodge in 1956. Personal communication with N. F. Johnson revealed that label data on a USNM specimen of this species (Hopkins US 15877) indicate it was reared from host eggs collected at DeLamar, Idaho, by H. R. Dodge in 1958.

Inostemma sp. — Platygasteridae

According to D. A. Ross, a single specimen of an unidentified species of *Inostemma* was obtained from a tussock moth egg mass collected in 1973 near Osoyoos, B. C. Only occasional records of this genus on Lepidoptera are known, and Clausen (1972) indicates that such records need further verification; normally hosts are Diptera or, less commonly, Homoptera.

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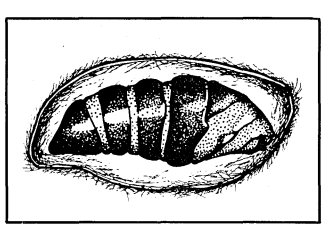

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Literature Cited

Averill, R. D.
1976. Parasitism of Douglas-fir tussock moth eggs in Denver. USDA For. Serv., For. Insect and Dis. Manage. Tech. Rep. R2-6, 4 p. Lakewood, Colo.

Balch, R. E.
1932. The fir tussock moth *(Hemerocampa pseudotsugata* McD.) J. Econ. Entomol. 25(8): 1143-1148.

Bedard, W. D.
1938. An annotated list of insect fauna of Douglas-fir *(Pseudotsuga mucronota rafinesque)* in the Northern Rocky Mountain Region. Can. Entomol. 70(9): 188-197.

Boucek, Z.
1977. Descriptions of two new species of Neotropical Eulophidae of economic interest, with taxonomic notes on related species and genera. Bull. Entomol. Res. 67:1-15.

Brookes, M. H., R. W. Stark, and R. W. Campbell, Eds.
1978. The Douglas-fir tussock moth: A synthesis. USDA Tech. Bull. 1585, 331 p. Washington, D. C.

Burke, H. E.
1906. Notes on the natural history of *Notolophus oslari.* Proc. Entomol. Soc. Wash. 8(1-2): 142-143.

Clausen, C. P.
1972. Entomophagous insects. Hafner Publ. Co., New York. 688 p.

Cushman, R. A.
1940. The Nearctic species of *Iseropus* (Hymenoptera: Ichneumonidae). Proc. Entomol. Soc. Wash. 42(3): 51-58.

Dahlsten, D. L., E. A. Cameron, and W. A. Copper.
1970. Distribution and parasitization of cocoons of the Douglas-fir tussock moth, *Hemerocampa pseudotsugata* (Lepidoptera: Lymantriidae), in an isolated infestation. Can. Entomol. 102(2): 175-181.

Dahlsten, D. L., R. F. Luck, E. I. Schlinger, J. M. Wenz, and W. A. Copper.
1977. Parasitoids and predators of the Douglas-fir tussock moth, *Orgyia pseudotsugata* (Lepidoptera: Lymantriidae), in low to moderate populations in central California. Can. Entomol. 109(5): 727-746.

Dodge, H. R.
1956. Tussock moth threatens timber. West. Conserv. J. p. 13, 36, 40-43, 45, 50, Jan.-Feb., 1956.

Eaton, C. B., and G. R. Strubble.
1957. The Douglas-fir tussock moth in California. Pan. Pac. Entomol. 33(3): 105-108.

Ferguson, D. C.
1978. *In* The moths of America north of Mexico, Fasc. 22.2, Noctuoidea (in part): Lymantriidae. R. B. Dominick and C. R. Edwards. E. W. Classey Ltd. and the Wedge Entomol. Res. Found., London.

Hopkins, A. D.
1906. Notes on egg parasites of *Notolophus oslari.* Proc. Entomol. Soc. Wash. 8(1-2): 142-143.

Krombein, K. V., and B. D. Burks, Eds.
1967. Hymenoptera of America north of Mexico. Synoptic catalog. USDA Agric. Monogr. 2, Second Suppl., 584 p. Washington, D.C.

Krombein, K. V., P. D. Hurd, D. R. Smith, and B. D. Burks, Eds.
1979. Catalog of Hymenoptera in American north of Mexico, Smithsonian Institution Press, Washington, D. C. Vol. 1-3. 2735 p.

Mason, R. R.
1976. Life tables for a declining population of the Douglas-fir tussock moth in northeastern Oregon. Ann. Entomol. Soc. Am. 69(5): 948-958.

Mason, W. R. M.
1981. The polyphyletic nature of *Apanteles* (Hymenoptera; Braconidae): A reclassification and phylogeny of the Microgastrinae. Mem. Entomol. Soc. Can. 110, 150 p.

Mathers, W. G.
1949. Douglas-fir tussock moth. Can. Dep. Agric. For. Insect Invest. Bi-monthly Prog. Rep. 5: 4.

Muesebeck, C. F. W., K. V. Krombein, and H. K. Townes, Eds.
1951. Hymenoptera of America north of Mexico. Synoptic catalog. USDA Agric. Monogr. 2, 1420 p. Washington, D. C.

Nagaraja, H., and S. Nagarkatti.
1973. A key to some New World species of *Trichogramma* (Hymenoptera: Trichogrammatidae), with descriptions of four new species. Proc. Entomol. Soc. Wash. 75(3): 288-297.

Peck, O.
1963. A catalogue of the Nearctic Chalcidoidea (Insecta: Hymenoptera). Can. Entomol., Suppl. 30, 1092 p.

Ryan, R. B., R. W. Mortensen, and T. R. Torgersen.
1981. Reproductive biology of *Telenomus californicus* Ashmead, an egg parasite of the Douglas-fir tussock moth: Laboratory studies. Ann. Entomol. Soc. Am. In press.

Shewell, G. E.
1971. On the type of *Agria,* with description of a new Nearctic species (Diptera: Sarcophagidae). Can. Entomol. 103(8): 1179-1191.

Sower, L. L., and T. R. Torgersen.
1979. Field application of synthetic Douglas-fir tussock moth sex pheromone did not reduce egg parasitism by two hymenoptera. Can. Entomol. 111(6): 751-752.

Stone, A., C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Coulson.
1965. A catalog of the Diptera of America north of Mexico. USDA Agric. Handb. 276, 1696 p. Washington, D. C.

Torgersen, T. R.
1977. Identification of parasites of the Douglas-fir tussock moth, based on adults, cocoons, and puparia. USDA For. Serv. Res. Pap. PNW-215, 28 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Torgersen, T. R., and D. L. Dahlsten.
1978. Natural mortality. *In* the Douglas-fir tussock moth: A synthesis, p. 47-53. M. H. Brookes, R. W. Stark, and R. W. Campbell, eds. USDA Tech. Bull. 1585, Washington, D. C.

Torgersen, T. R., and R. B. Ryan.
1981. Field biology of *Telenomus californicus* Ashmead, an important egg parasite of Douglas-fir tussock moth. Ann. Entomol. Soc. Am. 79: 185-186.

Townes, H.
1969. The genera of Ichneumonidae. Part 1. Mem. Am. Entomol. Inst. 11, 300 p. Ann Arbor, Mich.

Townes, H., and M. Townes.
1960. Ichneumon-flies of America north of Mexico: Part 2. Subfamilies Ephialtinae, Xoridinae, Acaenitinae. U.S. Natl. Mus. Bull. 216, 676 p. Washington, D. C.

Townes, H., and M. Townes.
1962. Ichneumon-flies of America north of Mexico: Part 3. Subfamily Gelinae, Tribe Mesostenini. U.S. Natl. Mus. Bull. 216, 602 p. Washington, D. C.

Tunnock, S.
1975. Impact of egg viability, egg parasitism, and virus on 1975 Douglas-fir tussock moth defoliation potential in the Lower Flathead Valley, Montana. USDA For. Serv., For. Environ. Prot. Rep. 75-9, 7 p. Div. State and Priv. For., Missoula, Mont.

Tunnock, S., R. L. Livingston, and W. E. Bousfield.
1974. Impact of egg viability, egg parasitism, and virus on 1974 Douglas-fir tussock moth defoliation potential in Northern Idaho. USDA Insect and Dis. Rep. 74-9, 8 p. Div. State and Priv. For., Missoula, Mont.

Tunnock, S., W. M. Ciesla, and S. Haglund.
1975. Supplemental egg mass data from a Douglas-fir tussock moth infestation north of Polson, Montana—April 1975. USDA For. Serv., For. Environ. Prot. Rep. 75-18, 5 p. Div. State and Priv. For., Missoula, Mont.

Tunnock, S., M. D. McGregor, and R. D. Lood.
1976. Natural mortality in a Douglas-fir tussock moth infestation in northern Idaho. 1974. USDA For. Serv., For. Environ. Prot. Rep. 76-8, 10 p. Div. State and Priv. For., Missoula, Mont.

Wickman, B. E., R. R. Mason, and C. G. Thompson.
1973a. Major outbreaks of the Douglas-fir tussock moth in Oregon and California. USDA For. Serv. Gen. Tech. Rep. PNW-5, 18 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Wickman, B. E., G. C. Trostle, and P. E. Buffam.
1973b. Douglas-fir tussock moth. Forest Pest Leaflet 86. 6 p.

Yoshimoto, C. M.
1978. Revision of the subgenus *Achrysocharella* Girault of America north of Mexico (Chalcidoidea, Eulophidae: *Chrysonotomyia* Ashmead). Can. Entomol. 110(7): 697-719.

Literature Cited - Unpublished[3]

Balch, R. E.
1930. The fir tussock moth; observations in 1929. USDA Bur. Entomol., For. Insect Field Stn., Coeur d'Alene, Idaho. Jan. 15, 1930. 25 p.

Dahlsten, D. L., E. I. Schlinger, R. F. Luck, and C. B. Williams.
1976. Investigations of endemic *Orgyia pseudotsugata* populations with emphasis on parasitoids, predators, and associated pest complex on white fir, *Abies concolor,* in California. Prog. Rep. USDA Expanded Douglas-fir Tussock Moth Res. and Dev. Program, 14 p.

Dodge, H. R.
1956. An analysis of Douglas-fir tussock moth cocoons in winter of 1955-1956, with reference to the trend of the current outbreak in eastern Washington. USDA For. Serv., For. Insect Lab., Missoula, Mont. 9 p.

Jennings, D. T.
1975. Natural enemies of the Douglas-fir tussock moth in the central Rocky Mountains and the Southwest. Prog. Rep. USDA Expanded Douglas-fir Tussock Moth Res. and Dev. Program, 13 p.

McComb, D.
1973. Biological evaluation: Douglas-fir tussock moth, Oregon and Washington, 1972-1973. USDA For. Serv., Div. Timber Manage., R-6, Portland, Oreg. 32 p.

[3]These unpublished reports are on file at the Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, Oregon 97331.

Mason, R. R., and T. R. Torgersen.
1977. Dynamics of low-density populations of the Douglas-fir tussock moth, with special emphasis on natural enemies. Final Rep., USDA Expanded Douglas-fir Tussock Moth Res. and Dev. Program, 62 p.

Rivas, A.
1959. The biology and control of the Douglas-fir tussock moth. Line Proj. Annu. Rep., USDA For. Serv., Rocky Mt. For. and Range Exp. Stn., Albuquerque, N. Mex. 3 p.

Volker, K. C., R. W. Clausen, A. R. Gittins, and H. W. Smith.
1977. Ecology of parasites and predators of the Douglas-fir tussock moth in the Pacific Northwest. Final Rep. Coop. State Res. Serv. Proj. 704-15-11. Univ. Idaho, Moscow. 67 p.

Yasinski, F. M., and D. L. Wheeler.
1962. Douglas-fir tussock moth. Line Proj. Annu. Rep., USDA For. Serv., Rocky Mt. For. and Range Exp. Stn., Albuquerque, N. Mex. 7 p.

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Torgersen, Torolf R.
1981. Parasite records for the Douglas-fir tussock moth. USDA For. Serv. Gen. Tech. Rep. PNW-123, 38 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

This is an annotated assemblage of parasite and hyperparasite records for the Douglas-fir tussock moth. Species in more than 50 genera in the Hymenoptera and Diptera are included. These records are from published literature, unpublished reports, and other miscellaneous sources. These last sources include specimens reared by the author, species identification files (Hopkins US), personal communication with collectors and taxonomists, and determinations by the author of material in collections throughout the West.

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